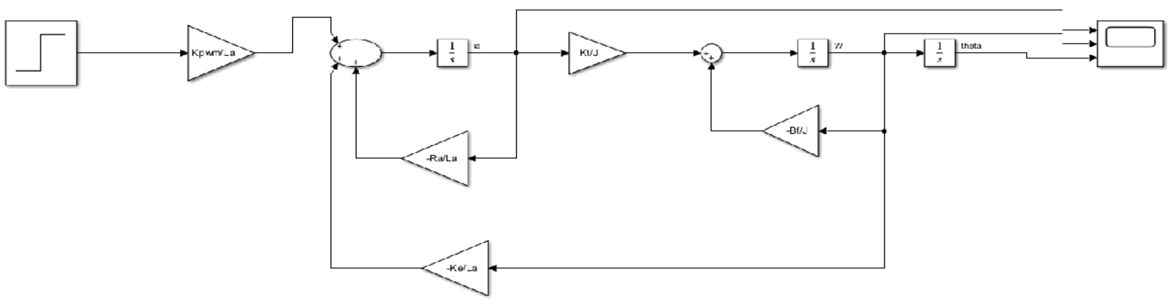
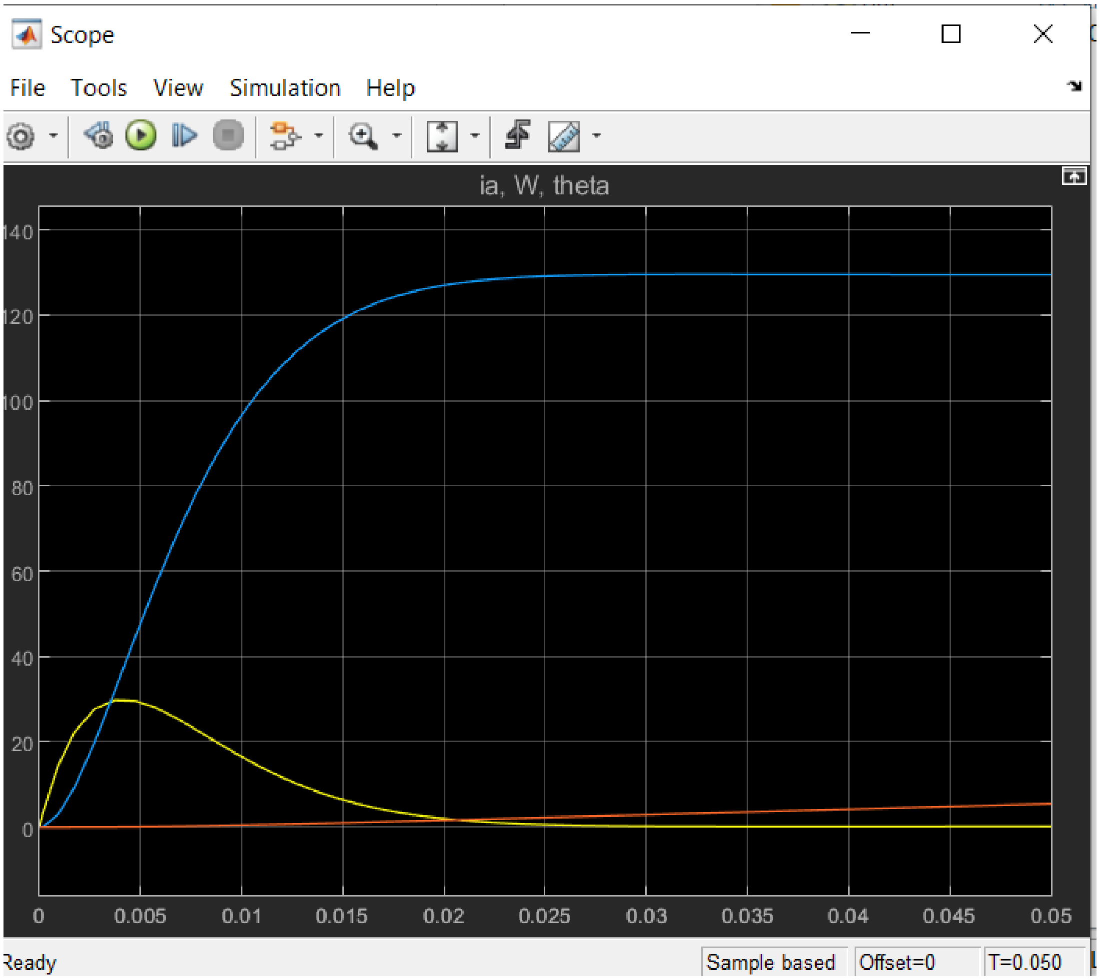
LAB 13 - POLE PLACEMENT

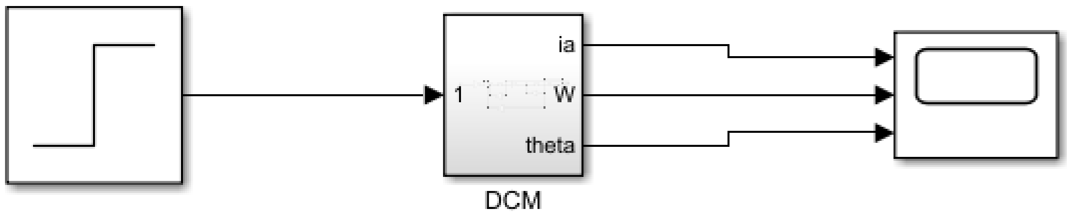
```
clear all
% pentru schema din simulink avem urmatorii parametrii de model
Ra=0.92;
La=2e-3;
Ke=0.2960;
Kt=0.2939;
Bf=3.35e-4;
J=7.01e-4;
Kpwm=38.4615;
% Schema motorului in simulink
```



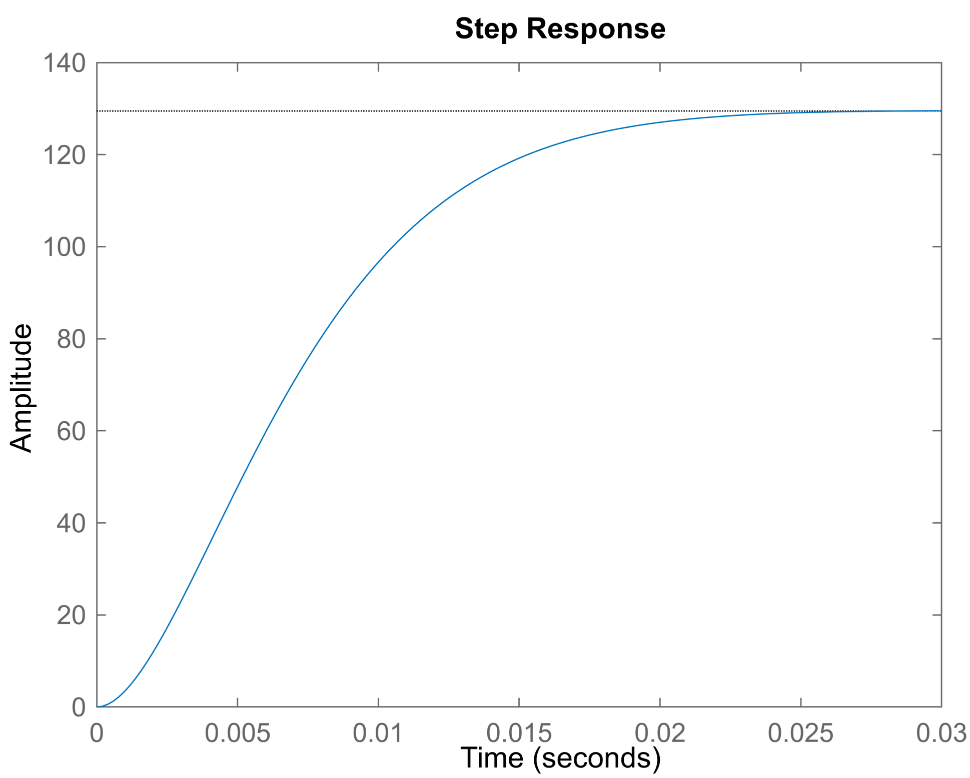

```
% Outputul pe scope
```



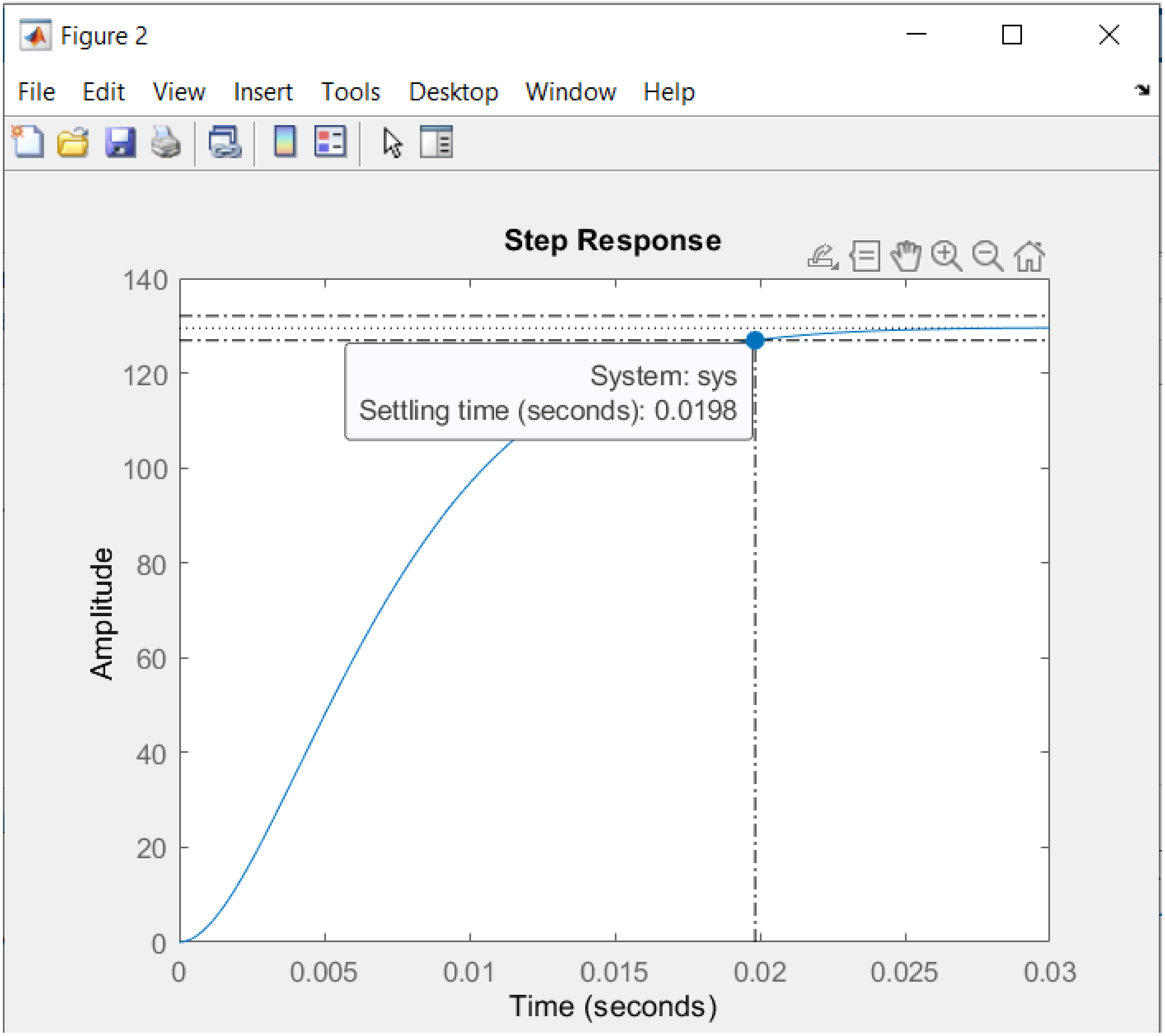

```
% Rotorul(portocaliu) creste la infinit
% Angular velocity(galben), initial forteaza motorul sa porneasca, dupa
% care revine la 0 deoarece motorul a ajuns in regim stationar.
% Turatia(albastru)


% Se selecteaza tot ce este intre step si scope, transformandu-l intru-un
% subsistem
```




```
% Se doreste controlul turatiei, asa ca in primul rand se defineste state
% space model-ul care va avea urmatoarea forma:

A=[-Ra/La, -Ke/La; Kt/J,-Bf/J];
B=[Kpwm/La,0;0 -1/J];
C=[0,1];
D=[0,0];

% Ne dorim sa reducem settling time-ul

step(A,B,C,D,1);
```




```
% Se observa ca settling time-ul e de 0.0198
```




```
% Putem reduce ts cu 10%, folosind plasarea polilor
eig(A)
```

```
ans = 2×1 complex
10^2 ×
  -2.3024 + 0.9623i
  -2.3024 - 0.9623i
```

```
p=eig(A)+eig(A)/10
```

```
p = 2×1 complex
10^2 ×
  -2.5326 + 1.0585i
  -2.5326 - 1.0585i
```

```
% Inainte sa calculam reactia starii, trebuie verificata matricea de
```

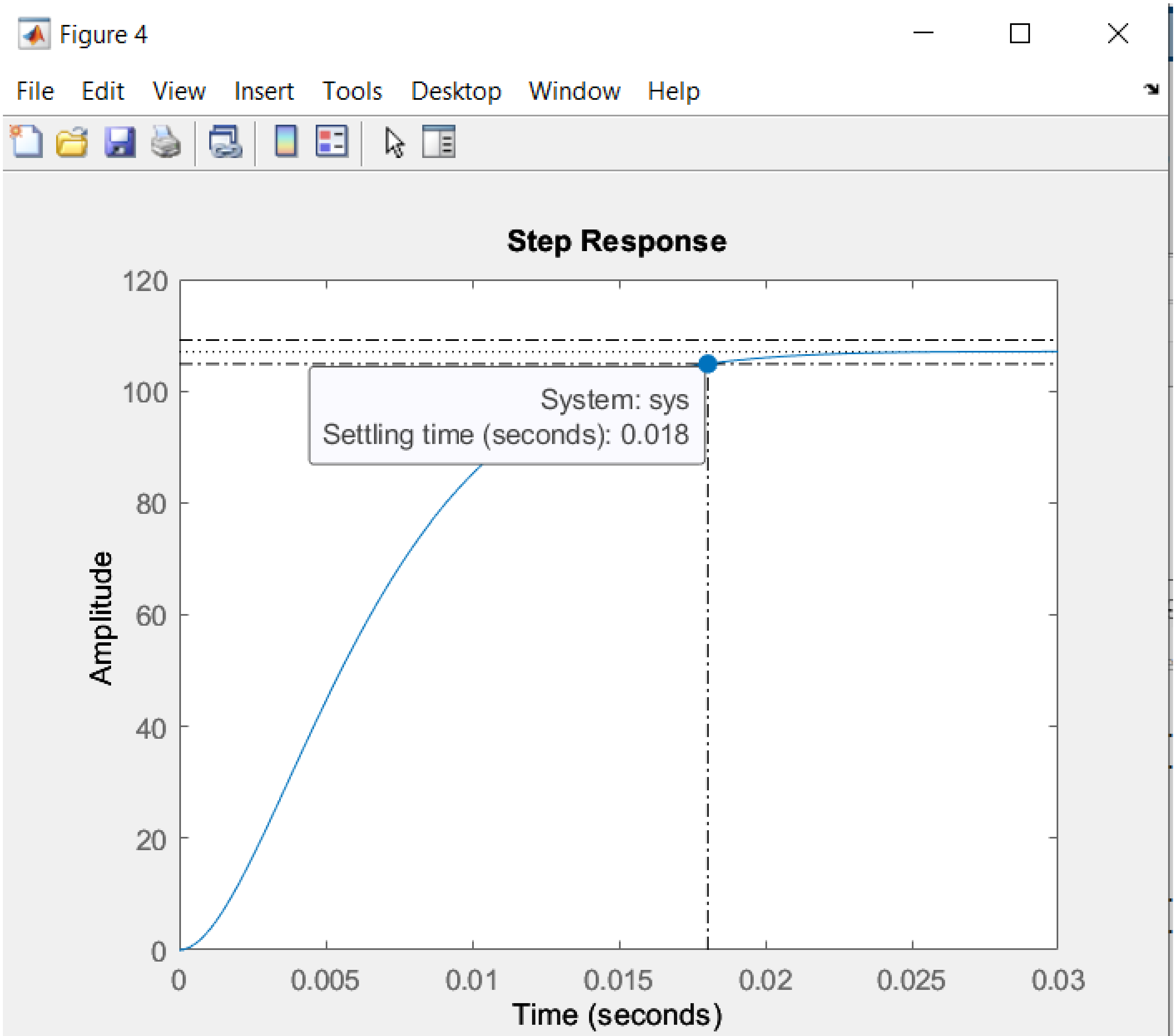
```
% controlabilitate

Co=ctrb(A,B(:,1));
R=rank(Co)
```

```
R = 2
```

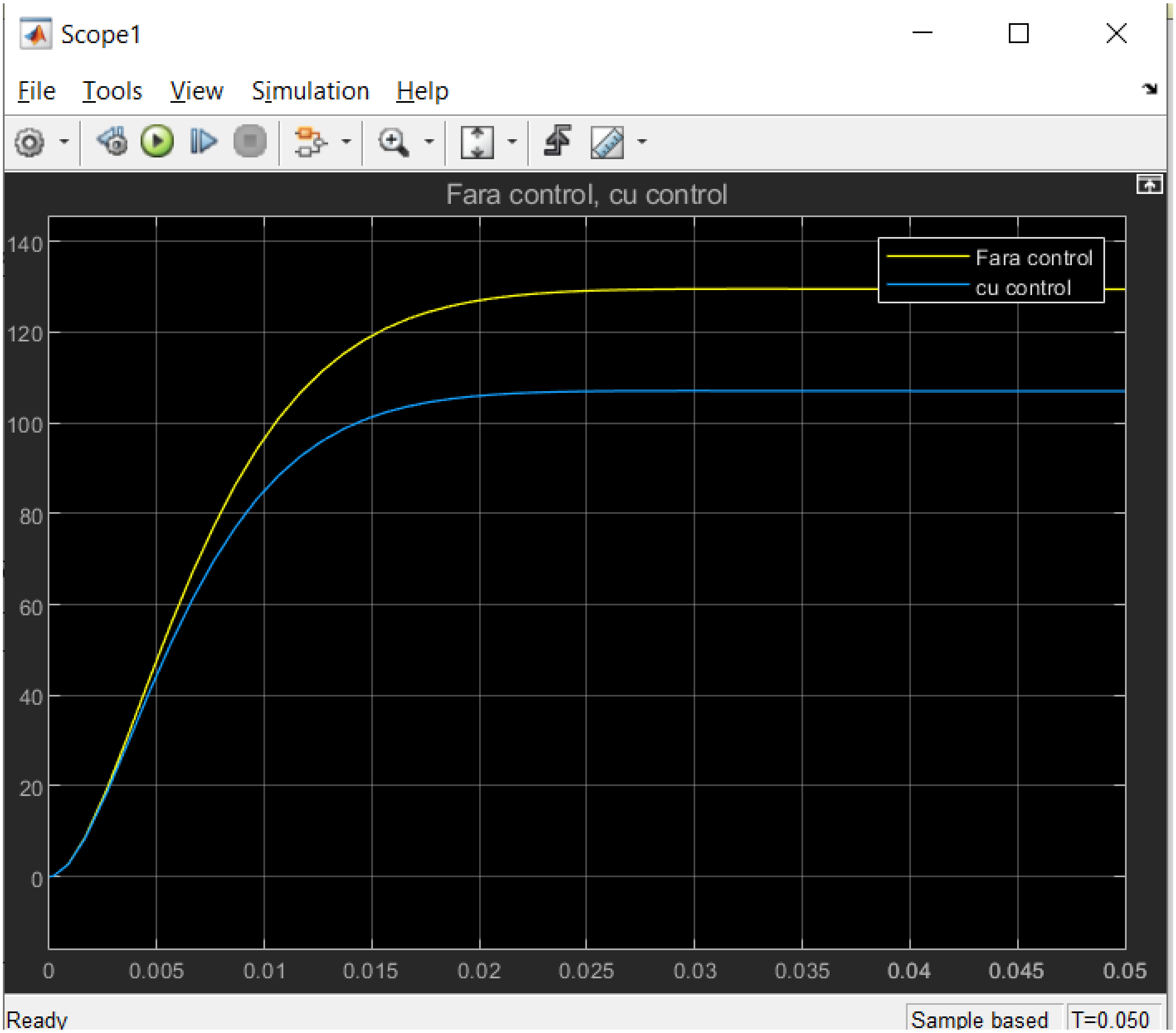
```
% Se observa ca rankul matricii Co este egal cu dimensiunea sa, deci
% sistemul este controlabil ceea ce rezulta ca putem aplica metoda plasarii
% polilor

Kx=acker(A,B(:,1),p)
```

```
Kx = 1×2
    0.0024    0.0016
```

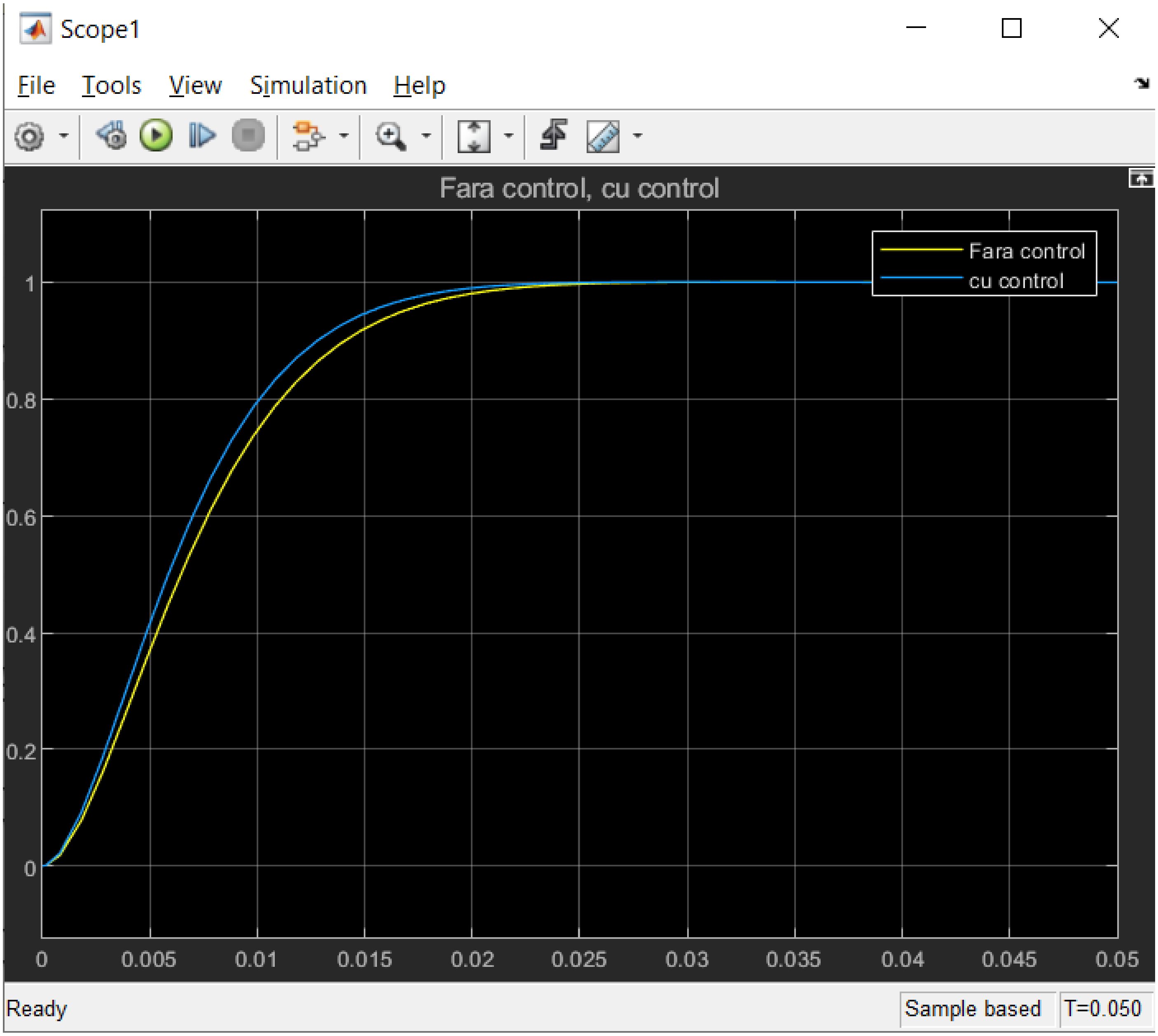
```
Ar=A-B(:,1)*Kx;
Br=B;
Cr=C;
Dr=D;

% Se observa ca settling time-ul a scazut
```




```
% Cand implementam partea de contol in simulink se observa ca
% se schimba valoarea stationara, asa ca trebuie sa le aducem
% la aceeasi valoare
```




```
% Pentru a le aduce la aceeasi valoare stationara

Fx_ol=inv((C*inv(-A)*B(:,1)));
Fx_cl=inv((C*inv(-Ar)*B(:,1)));
```


Scope1
File Tools View Simulation Help
Fara control, cu control
Fara control
cu control
1
0.8
0.6
0.4
0.2
0
0 0.005 0.01 0.015 0.02 0.025 0.03 0.035 0.04 0.045 0.05
Ready
Sample based
T=0.050